Aruba Mobility Controller Configuration and Deployment Guide

SpectraLink's Voice Interoperability for Enterprise Wireless (VIEW) Certification Program is designed to ensure interoperability and high performance between wireless IP telephones and WLAN infrastructure products. The products noted below have been thoroughly tested in SpectraLink's lab and have passed VIEW Certification. This document details how to configure the Aruba mobility controller for use with wireless IP telephones.

Certified Product Summary

Manufacturer:	Aruba Networks: www.arubanetworks.com			
Approved products:	Wireless Controllers	Access Points		
	A200 A800 A2400 A6000 †	AP41 AP60 AP61 AP65 AP70 †		
RF technology:	802.11b/g/a			
Radio:	2.4 GHz (802.11 b/g), 5 GHz (802.11a)			
Security :	WPA2-PSK			
AP firmware version tested:	2.5.4.X			
Handset models	3616/3620/3626	3641/3645		
Radio mode	802.11b	802.11b	802.11g	802.11a
Maximum telephone calls per AP:	12	12*		
Network topology:	Switched Ethernet (recommended)			

† Denotes products directly used in Certification Testing

* Maximum calls tested during VIEW Certification and the recommended setting in the AVPP. The certified product may actually support a higher number of calls for 802.11a and 802.11g radio modes.

Service Information

If you encounter difficulties or have questions regarding the configuration process, please contact Aruba Networks technical support at 1-800-943-4526, visit www.arubanetworks.com/support or e-mail support@arubanetworks.com.

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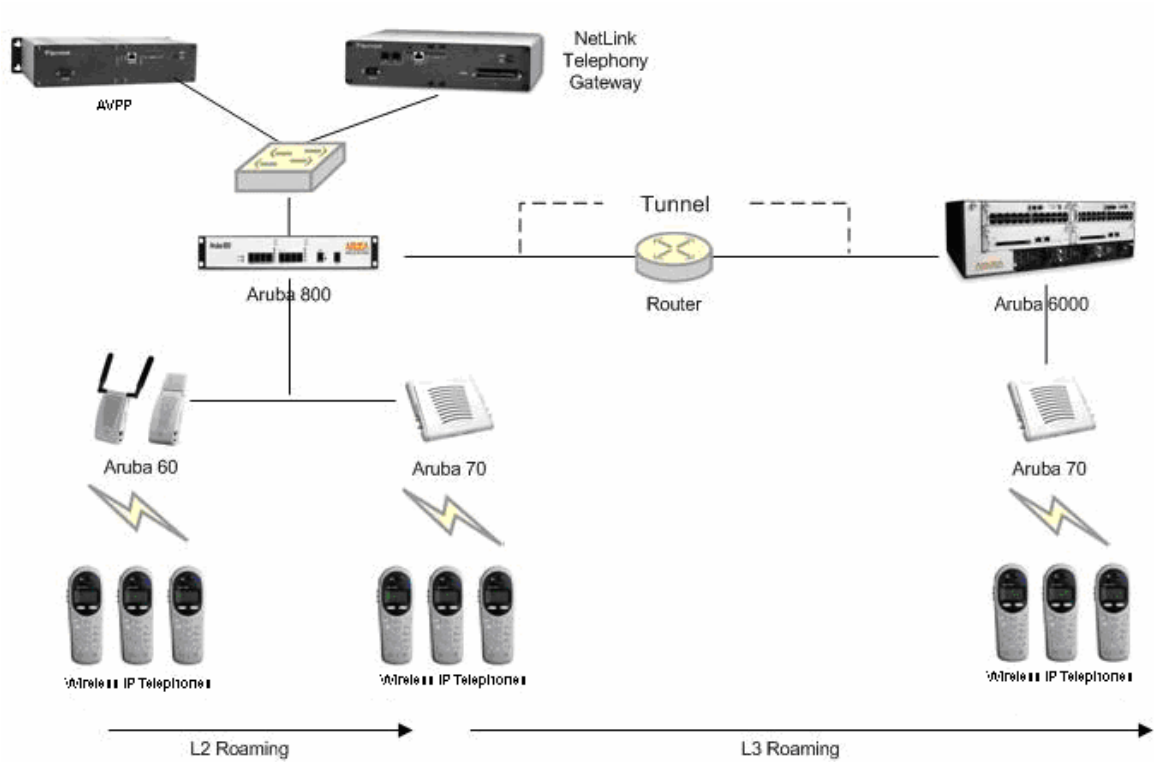
Network Topology

The following topology was tested during VIEW Certification testing.



Deployment Description

It is required that voice users be placed on a separate VLAN (e.g., VLAN 10) and data users on a separate VLAN (e.g., VLAN 25). The voice and data VLANs reside on the Aruba mobility controller and not on the access points (APs). The user traffic is tunneled back to the Aruba controller for processing. The edge network thus does not have to be modified to accommodate the WiFi clients and the VoWiFi network. Map each VLAN to a unique subnet. The mobility controller (switch) IP address needs to be set via the loopback interface setting. The Controller's loopback address must be a routable address so that the APs can reach this address.

Interface setting

Identify the mobility controller port that serves as the uplink port for the data VLAN. The port used in this example is Fast Ethernet 1/0 and is a trunk port with both the voice and data VLAN.

Default route

The L3 switch connected to the Aruba controller serves as the default gateway for all the WiFi clients. Configure the default route to the next-hop gateway connected to the mobility controller.

Physical interface

All interfaces that connect to the core networks, routers, servers and gateways need to be set as trusted ports.

Connecting the APs

The APs need an IP address for communication with the mobility controller. The APs can connect to the controller over a L2 or L3 network. Ensure that DHCP is enabled on the subnets the APs are connected to and can ping the Aruba mobility controller's "switch IP address" from their current subnet.

Known Limitations

No limitations were discovered during VIEW Certification testing.

VIEW Certification testing verifies that the wireless telephone and the AP interoperate at the packet level; therefore, no add-on vendor features were tested in the scope of VIEW.

Connecting to the Mobility Controller

Command, comment, and screen text key

In the sections below you will find commands, comments, prompts, system responses, or other screen-displayed information involved in the configuration process. This key explains the text styles and symbols used to denote them.

Text Style	Denotes:
xxxxxxxx	Typed command
<xxxxxxxx>	Encryption key, domain name or other information specific to your system that needs to be entered
(xxxxxxxx)	Comment about a command or set of commands
xxxxxxxx	Prompt, system response or other displayed information

Via console

1. Using a standard RS-232 cable, connect the mobility controller to the serial port of a terminal or PC.
2. Run a terminal emulation program (such as HyperTerminal) or use a VT-100 terminal with the following configuration:

Bits per second:	9600
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

3. Press Enter to display the Aruba mobility controller login screen.
4. Enter the default login: **admin** and the default password: **admin**. These are case sensitive.
5. Enter **enable** and the default password: **admin** to get into the command mode.

Via the CLI

By default, only SSH (Secure SHell) access to the switch (mobility controller) is permitted.

1. From a management system that has network connectivity to the switch, connect to the switch using SSH:

   ssh admin@<switch IP address>

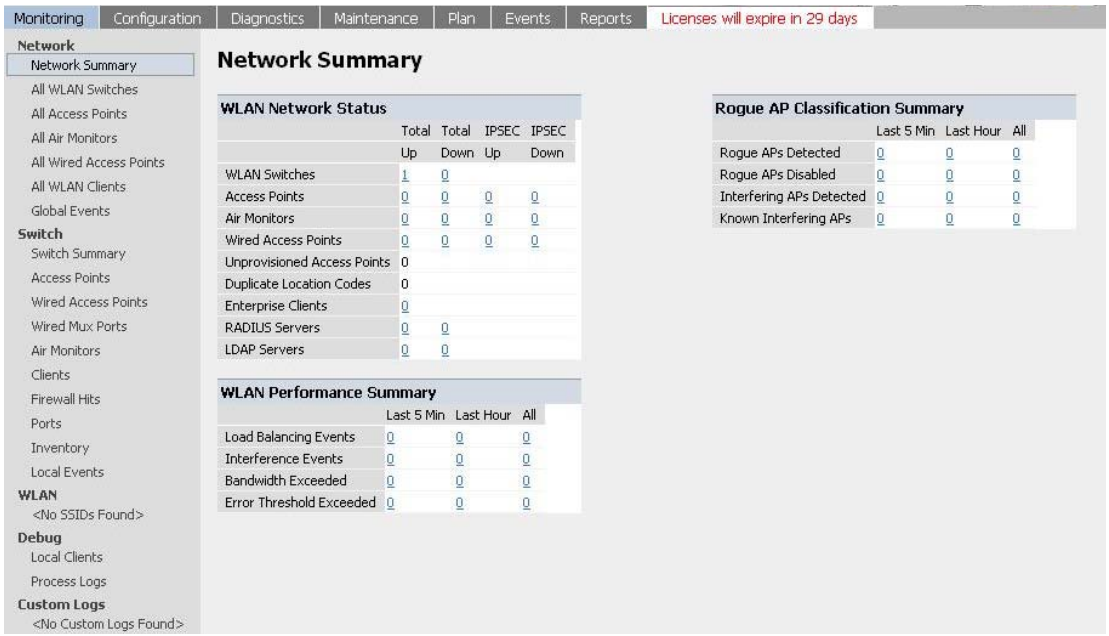
2. Enter the admin password at the password prompt.
3. Type **`enable`** at the **>** prompt to enter the enable mode.
4. Type the enable password when prompted for a password.

Via the Web interface

Once the connectivity to the switch is verified, open a Web browser and enter the switch's IP address in the navigator bar.

The switch can be accessed using http, **http://<switch IP Address>**
or https, **https://<switch IP Address>:4343.**

The user is prompted with the username and password configured (in the example above, the **`username/password`** configured is **`admin/admin`**). On successful login the following **Network Summary** screen is displayed:



Initial Setup

Before starting, please ensure that the Policy Enforcement Firewall module license is enabled on the Aruba mobility controller. Please contact Aruba Networks for licenses and installation information.

On power-up, the user is presented with the startup wizard:

```
Enter System name [Aruba800]: Aruba
Enter VLAN 1 interface IP address [172.16.0.254]:
Enter VLAN 1 interface subnet mask [255.255.255.0]:
Enter IP Default gateway [none]:
Enter Switch Role, (master|local) [master]: master
Enter Country code (ISO-3166), <ctrl-I> for supported list: US
You have chosen Country code US for United States (yes|no)?: yes
Enter Password for admin login (up to 32 chars): admin
Re-type Password for admin login: admin
Enter Password for enable mode (up to 15 chars): enable
Re-type Password for enable mode: enable
Do you wish to shutdown all the ports (yes|no)? [no]: no

Current choices are:

System name: Aruba
VLAN 1 interface IP address: 172.16.0.254
VLAN 1 interface subnet mask: 255.255.255.0
IP Default gateway: none
Switch Role: master
Country code: US
Ports shutdown: no

If you accept the changes the switch will restart!
Type <ctrl-P> to go back and change answer for any question.
Do you wish to accept the changes (yes|no)yes
. . . . .

<<<<<   Welcome to Aruba Wireless Networks - Aruba 800  >>>>>
. . . .

(Aruba)
User:
```

Assigning an IP to the Mobility Controller

1. Connect to the switch via the CLI.
2. Login with the configured username and password, **admin /admin** in this example.
3. Type **enable** at the > prompt.
4. Type the enable password, **enable** in this example.
5. Type **configure terminal** at the # prompt.
6. Create the vlan for the voice (vlan 25) using the vlan command:

   ```
   (Aruba) (config) #vlan 25
   ```

7. Create the vlan interface.

   ```
   (Aruba) (config) #interface vlan 25
   ```

8. Assign the IP address to the interface.

   ```
   (Aruba) (config-subif)#ip address 10.168.10.2 255.255.255.0
   ```

9. Create the loopback interface and assign an IP address to the loopback. For more information about the loopback interface refer to the user guide.

   ```
   (Aruba) (config) #interface loopback
   (Aruba) (config-loop)#ip address 10.168.10.1
   Switch IP Address is Modified. Switch should be rebooted now
   (Aruba) (config-loop)#!
   (Aruba) (config) #ip default-gateway 10.168.10.10
   ```

10. Assign a physical interface to the vlan. In this example, the interface connecting to the network is a trunk interface. Configure the mode on the interface to a trunk mode.

    ```
    (Aruba) (config) #interface fastethernet 1/0
    (Aruba) (config-if)#trusted
    (Aruba) (config-if)#no shutdown
    (Aruba) (config-if)#switchport mode trunk
    (Aruba) (config-if)#switchport trunk allowed vlan add 10,25
    (Aruba) (config-if)#!
    (Aruba) (config)#
    ```

11. Ping the default gateway from the switch's console.
12. Ping the switch's IP address from the management station.

Connecting APs

Provisioning APs

The APs need to be provisioned. The Aruba APs can be provisioned manually or be configured for automatic provisioning. For manual provisioning, use the Web-based AP provisioning Web page. Refer to the AP Provisioning User Guide for instructions on provisioning the AP.

The APs can communicate with the controller over a L2 or L3 network. The only requirement is that each AP be assigned an IP address and default gateway using DHCP.

SSID Configuration

CLI command configuration

APs can be configured using the CLI or the Web interface. Each AP is identified by a unique location code. The APs can either be configured per location with unique settings using the AP's unique location code or globally using the wildcard location. "**0**" is used as the wildcard.

Example: **ap location 0.0.0** will configure all Aruba APs on the WLAN system. Both the Aruba APs and the Spectralink handsets support the 802.11a and the 802.11b/g radios. To apply the SSID to both bands configure the SSID as follows:

```
configure terminal
 ap location x.y.z
 virtual-ap aruba vlan-id 26 opmode wpa2-aes-psk
 wpa-passphrase thisisthekey  dtim-period 3
```

If the voice network needs to exist only in the 802.11a band, configure the virtual AP under the 802.11a settings on the controller.

```
configure terminal
 ap location x.y.z
 phy-type a virtual-ap aruba vlan-id 26 opmode wpa2-aes-psk
 wpa-passphrase thisisthekey  dtim-period 3
```

If the voice network needs to exist only in the 802.11g band , configure the virtual AP under the 802.11a settings on the controller.

```
configure terminal
 ap location x.y.z
 phy-type g virtual-ap aruba vlan-id 26 opmode wpa2-aes-psk
 wpa-passphrase thisisthekey  dtim-period 3
```

To save changes, enter:

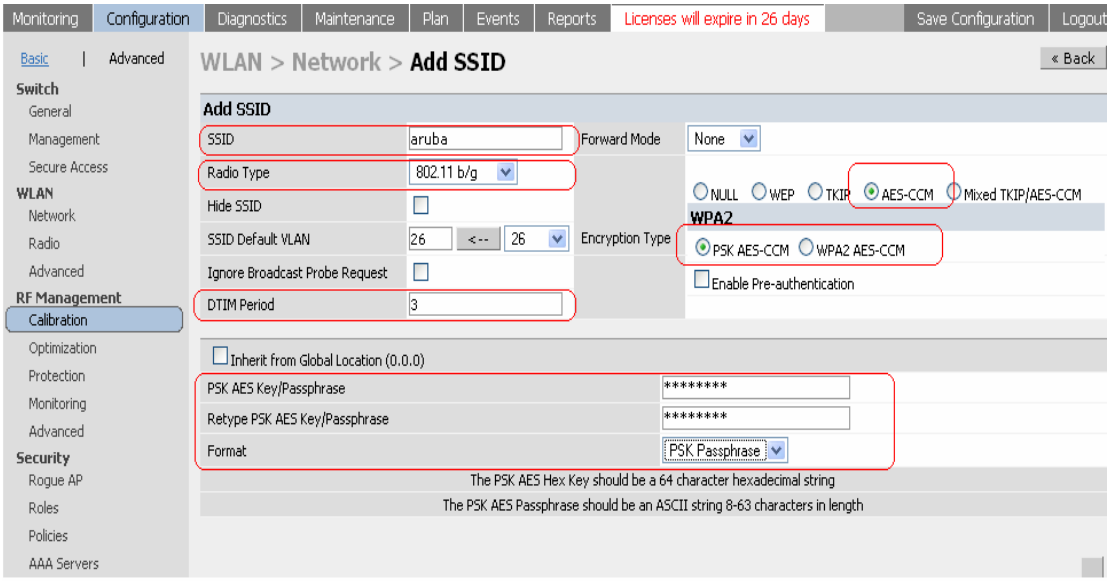
```
write mem
```

Web-based configuration

1. Click the **Configuration** button.
2. In the navigation pane, select **Network** from the **WLAN** sub-menu.
   a. To edit an existing AP profile, click the **Edit** button corresponding to the SSID.
   b. To add a new profile, click the **Add** button.
3. Under **Add SSID**, enter **aruba** in the **SSID** field**.**
4. Select **802.11a/b/g** from the **Radio Type** drop-down list.
5. For the **SSID Default VLAN**, enter the voice VLAN number.
6. For the **DTIM Period**, enter **3.**

7. Select the **AES-CCM** option for WPA2-AES-PSK encryption.
8. Under **WPA2**, select the **PSK AES-CCM** option.
9. Select **PSK Passphrase** (alphanumeric) from the **Format** drop-down list before typing in the passphrase.
10. Enter the **PSK AES Key/Passphrase**.
11. Click the **Apply** button.

Navigating to other pages without saving/applying the changes will result in the loss of the changes.



Access Point Configuration

Radio setting 802.11b or 802.11g

When using the 802.11b/g band for the VoWiFi network, set the radio settings to 802.11b/g mixed mode.

Preamble settings

The tests on the Aruba system were run with the short preamble setting.

The short preamble setting can be used, as this supports both short and long preambles. Wireless IP Telephones only support long preamble.

When using a dual-radio AP, use the 802.11a radio for data and 802.11b/g for voice if possible, as this will improve the overall performance.

Channel and Tx power

Channel and Tx power level can be manually set or configured to be assigned automatically depending on the RF environment. Please consult your facility's RF site survey designed for voice to determine the correct channel, power and data rate settings. NetLink wireless telephones require the following minimum dBm reading to support the corresponding "Required" data rate setting in the access point.

802.11 Radio Standard	Minimum Available Signal Strength (RSSI)	Maximum "Required" Data Rate
802.11b	-70 dBm	1 Mb/s
	-60 dBm	11 Mb/s
802.11g	-63 dBm	6 Mb/s
	-47 dBm	54 Mb/s
802.11a	-60 dBm	6 Mb/s
	-45 dBm	54 Mb/s

For additional details on RF deployment please contact your service representative.

Recommended AP configuration settings

CLI Commands	Required Settings	Default Settings	Description
Max-clients <x>	40	0	Max clients that can associate with the AP.
Beacon-interval <x>	Set to default	100 milliseconds	The interval at which beacons are sent out .
dtim-period <x>	3	1	Delivery Traffic Indication Message interval in terms of beacon interval.
hide-essid <enable / disable>	Enable	Disable	To disable the ESSID from being broadcasted.
Max-retries	2	4	Maximum number of times the AP tries to send a packet to the client before discarding the packet.
b/g-mode	Mixed	Mixed	The radio mode of the b/g radio.

CLI Commands	Required Settings	Default Settings	Description
Tx-power <0-4>		0	As per the environment. This need not be set if ARM is enabled.
Channel <x>		1	This is the channel assigned to the radio. Need not be set if ARM is enabled.
802.11b/g rates	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	5,11	
802.11b/g Tx rates	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	1,2,5,11	The supported Tx rates for 802.11b/g.
802.11b/g rates (if all wireless client are 802.11g)	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	5,11	
802.11b/g Tx rates (if all wireless client are 802.11g)	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	1,2,5,11	
802.11a rates	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	6,9,12,24	
802.11a Tx rates	These rates should be determined from RF site survey. Verify you have sufficient coverage to support data rates.	6,9,12,18,24, 36,48,54	The supported Tx rates for 802.11a.
ESSID	<voice ssid as configured>	Aruba	This is the ESSID that the voice devices would associate with.

CLI Commands	Required Settings	Default Settings	Description
Short preamble	Tested: Enable Recommended: Disable	Enable	Set the short preamble to disable, to enable long-preamble-only support.

CLI command configuration

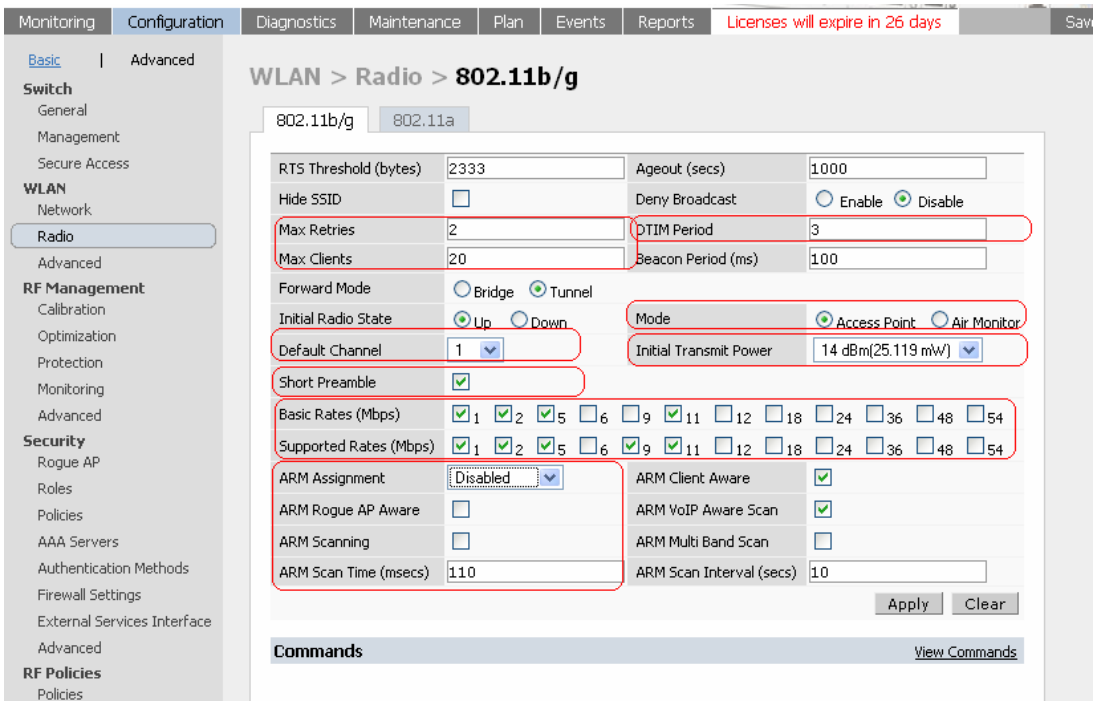
All of the commands listed in the CLI Commands column above must be entered under the **ap location** command.

The format is:

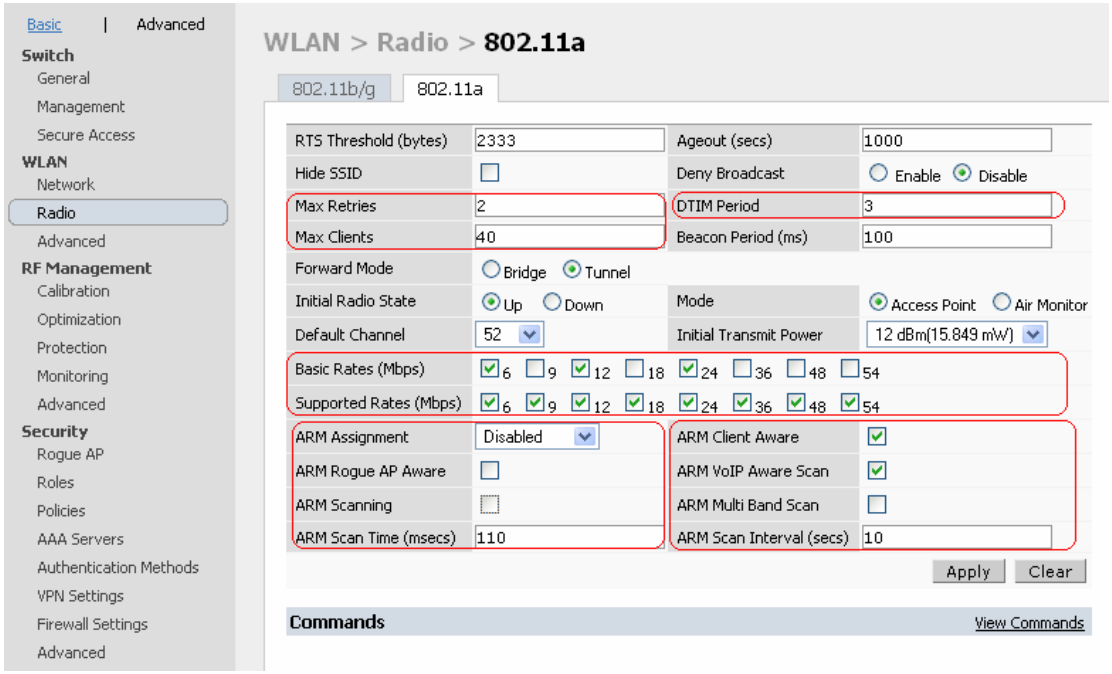
```
ap location x.y.z
 phy-type g (To make the changes for the “g” radio.)
  commands
!
 phy-type a (To make the changes for the “a” radio.)
  commands
!
```

Web-based configuration

1. Click the **Configuration** button.
2. In the navigation pane, select **Radio** from the **WLAN** sub-menu.
3. Click the **802.11b/g** tab.
4. For **Max Retries**, enter **2** for voice.
5. Select the **Short Preamble** check box.
6. For the **DTIM period**, enter **3**.
7. For **Basic Rates** and **Supported Rates,** consult the facility's RF site survey to determine if coverage is sufficient to support all data rates.
8. To assign the power and channel setting manually:
   a. For **ARM Assignment**, select **Disabled.**
   b. Clear the **ARM Scanning** check box.
   c. Set the **Default Channel** and **Initial Transmit Power** from their drop-down lists.
9. For **Mode**, click the **Access-point** option.
10. Click the **Apply** button.



11. Click the 802.11 a tab.
12. For **Max Retries**, enter **2** for voice.
13. For the **DTIM period**, enter **3**.
14. For **Basic Rates and Supported Rates,** consult the facilities RF site survey to determine if coverage is sufficient to support all data rates.
15. To assign the power and channel setting manually:
    a. For **ARM Assignment**, select **Disabled.**
    b. Clear the **ARM Scanning** check box.
    c. Set the **Default Channel** and **Initial Transmit Power** from their drop-down lists.
16. For **Mode**, click the **Access-point** option.
17. Click the **Apply** button.



Dynamic RF Management - ARM Aware Scanning

If Adaptive Radio Resource Management (ARM) Aware Scanning (RF scanning) is included in your firmware release, it can be enabled through the command line interface as follows:

```
configure terminal
   ap location x.y.z
   phy-type g
   arm scanning enable
   arm assignment single-band
   arm voip-aware-scan enable
   write mem
```

This feature was enabled during VIEW Certification testing in a screen room (strong signals in a clean environment). A real-world test with interfering RF signals was not simulated.

Security Policies and Quality of Service (QoS)

Once the basic infrastructure is configured, it is necessary to configure the security policies to ensure that the data network and the voice network are secured and access to these networks is limited as required.

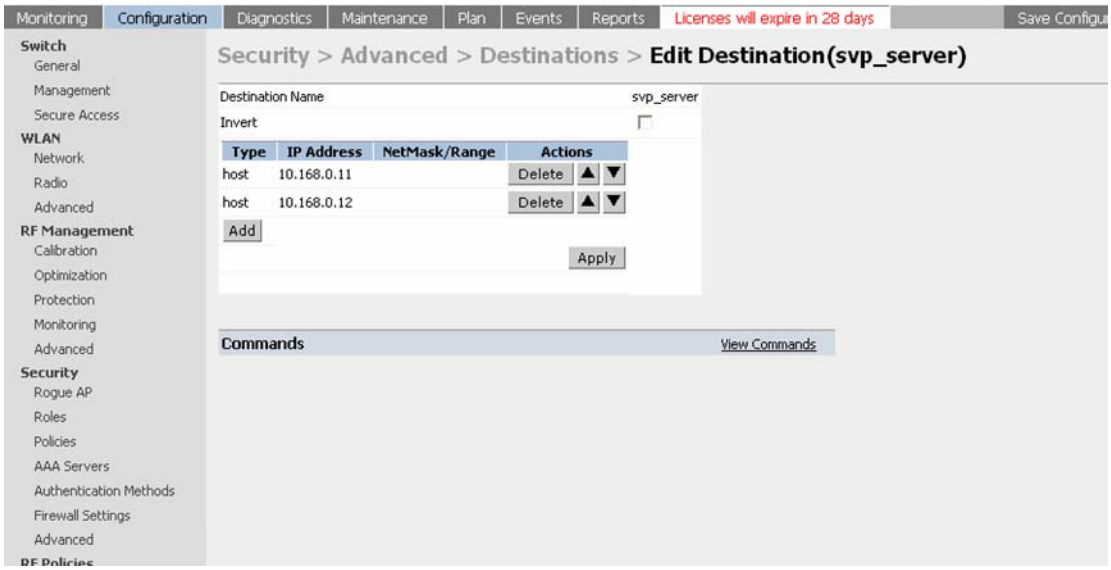
The steps are as follows:

1. Setup aliases for the AVPP.
2. Set policies for the wireless IP telephone User to the required voice server, DHCP and TFTP servers. Add other ACLs as required to permit other traffic from the wireless IP telephones.
3. Assign policies to the role.

Create an alias for the AVPP

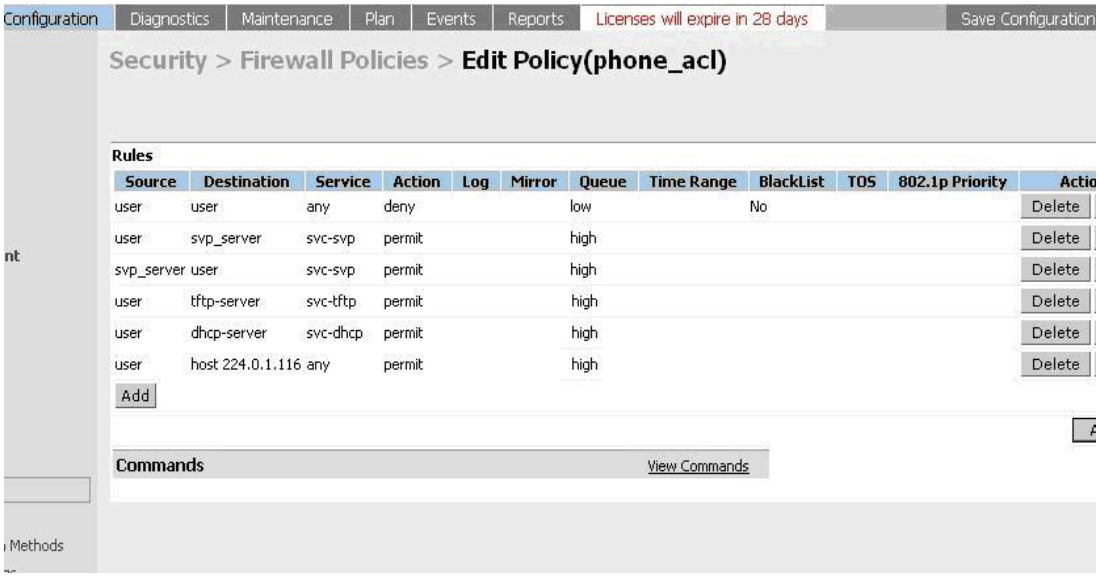
1. Click the **Configuration** tab.
2. In the navigation pane, select **Advanced** from the **Security** sub-menu.
3. Click the **Destinations** tab.
4. To add a new destination, click the **Add** button.
5. Create a new net-destination at **Destination Name** (e.g. **avpp**), and add the AVPPs as hosts.

For more details on configuring the net-destinations refer to the Aruba User Guide.



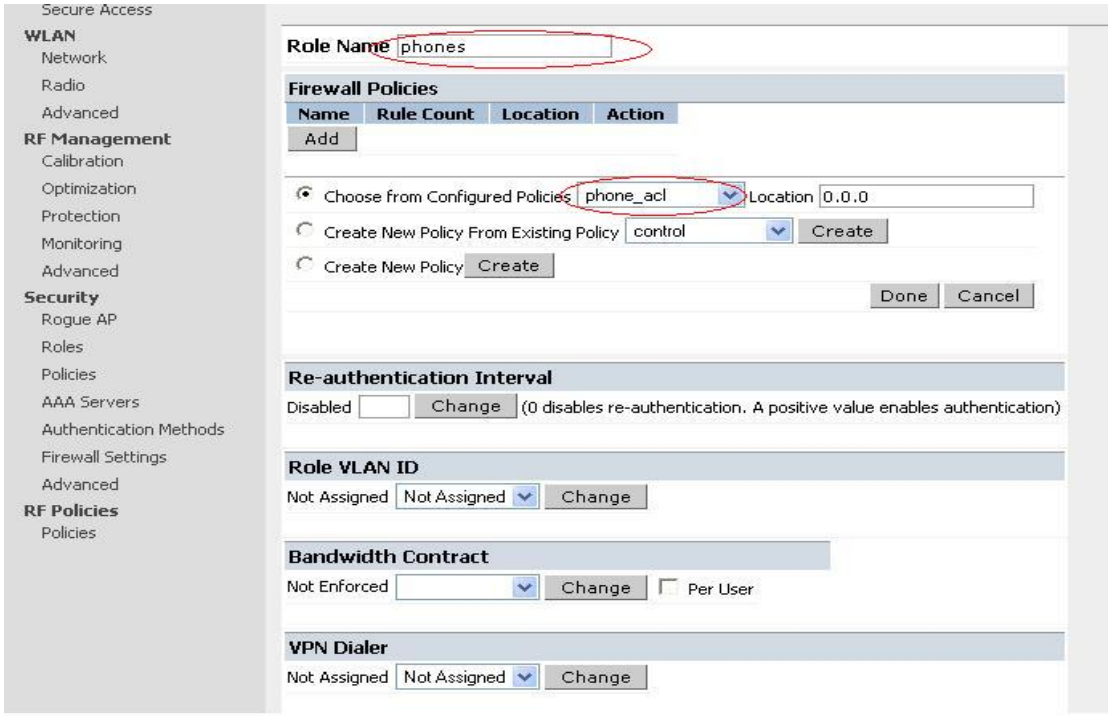
Create policies for the wireless IP telephone user

The policies shown in the above example can be configured using the Web interface as follows:



Assign policies to the role

Create a role, for example **phones**, and assign the policies to this role. This is the role that will be assigned to the handsets when they are authenticated successfully.



The Security Policies and QoS can also be configured through the command line interface (CLI). The CLI commands corresponding to this section are as follows:

```
configure terminal
netdestination tftp-server
host 10.168.0.20
!
netdestination avpp
host 10.168.0.11
host 10.168.0.12
!
netdestination dhcp-server
host 10.168.0.21
!
ip access-list session phone_acl
user user any deny
user alias avpp svc-avpp permit queue high
alias avpp user svc-avpp permit queue high
user alias tftp-server svc-tftp permit
user alias dhcp-server svc-dhcp permit
user host 224.0.1.116 any permit
!
```

```
user-role phones
session-acl phone_acl
!
```

Authentication

In addition to the encryption, it is recommended that you use MAC authentication to authenticate the wireless IP telephones. On the Aruba System, the roles for wireless IP telephones are derived using MAC-authentication. The wireless IP telephones can be authenticated individually using MAC-authentication or as a group using the vendor OUI and derivation rules. For instruction on enabling MAC-authentication refer to Aruba's User Guide.

For the OUI-based derivation rule, configure the following from the CLI:

```
aaa derivation rules user
set role condition macaddr starts-with "00:90:7a" set-value phone
```

Quality of Service (QoS)

Quality of service is achieved by prioritizing the voice traffic over data traffic. To prioritize the voice traffic over data traffic in the AP traffic queues, the "queue high" tag is used at the end of each ACL to prioritize the traffic matching the ACL over all other traffic. In the example shown above:

```
user alias avpp svc-avpp permit queue high
alias avpp user svc-avpp permit queue high
```

The traffic that matches the above two rules is prioritized over all other traffic. In addition, a DiffServ tag or a Dot1p tag can be configured at the end of each ACL to indicate the relative priority of the traffic to the traffic to the network.

Example:

```
user alias avpp svc-avpp permit dot1p 4 queue high dot1p-priority
4 tos 4 queue high
alias avpp user svc-avpp permit queue high dot1p-priority 4 tos 4
queue high
```

By default, the packets are not tagged.

In addition multicast/bradcast traffic in the air can be limited by turning on the firewall voip-prox-arp. This command is available on the CLI alone.

```
(Aruba)# configuration terminal
(Aruba) (config)# firewall voip-proxy-arp
```

Subnet Roaming

The Aruba system can be set up to support inter-switch inter-subnet roaming. The topology is as shown in the figure on page 2.

When two or more switches are used in the Aruba WLAN system, one switch has to be identified as the master and the others as the local switch. During VIEW Certification testing, the Aruba 800 was configured as the master switch and the Aruba 6000 was configured as a local switch; therefore, this configuration is used in the following examples.

For instructions on setting up a switch as a local switch refer to Aruba's User Guides.

Ensure that both switches have IP connectivity. A simple ping from each of the switches to the other switch can be used to verify connectivity. In a master local setup all AP, authentication, and firewall configurations will be made on the master and pushed down to the local switch.

In the configuration tested, all APs with location code 1.1.0 were configured to boot off of the master switch and all APs with location code 1.2.0 were configured to boot off of the local switch.

To use the Web interface to configure the switches for subnet roaming, do the following:

1. From the master switch navigate to the **Configuration > WLAN > Advanced** tab.
2. Add a new location **1.1.0** and click the **Apply** button.
3. In the next page click **General** and set the **LMSIP** to the switch IP address of the master.
4. Apply the configurations.
5. Configure location **1.2.0 i**n a similar manner and set the **LMSIP address** to the switch IP address of the local switch.
6. Create a default route for multicast traffic re-direction on the switch that acts as the Mobility Home Agent for the **Voice** group (this was done on the master switch in the test example).

CLI commands to set up subnet roaming

Commands for the master switch (the Aruba 800):

```
Configure terminal
   ip default-gateway <ip_addr of router>

   ap location 1.1.0       (AP connected to the Aruba 800)
   lms-ip <ip_addr of 800 switch>

   ap location 1.2.0       (AP connected to the Aruba 6000)
   lms-ip <ip_addr of 6000 switch>

   ip route 224.0.0.0 255.0.0.0 <ip_addr of NetLink Gateway>
   exit
   write mem
```

Commands for the local switch (the Aruba 6000):

The AP's IP address must be on same sub-net as the switch.

```
Configure terminal
      masterip <ip address of the master>
      interface loopback
      ip address <ip_addr of the 6000>
   vlan 1
   interface vlan 1
   ip address <ip_addr of the 6000> <netmask>
   interface fastethernet <port>
   switchport access vlan 1  (only if the port is an access port)
   trusted
   no shut
            !
   ip default-gateway <ip_addr of router>
            !
   exit
   write mem
```

After the master IP and the switch IP address are configured on the local switch, the switch needs to be rebooted prior to use.

It is also necessary to set the default gateway of the Avaya Voice Priority Processor and NetLink Telephony Gateway to the IP address of the router connected to the master switch.

Commands to verify setup for sub-net routing

From the Aruba 800:

```
show master ip              (should be 800's ip)
show stm connectivity       (shows the APs connected to the Aruba
                            800 switch)

Ping the local switch.
Pings should be successful.
```

From the Aruba 6000:

```
show master ip              (should be 800's ip)
show stm connectivity       (shows the APs connected to the Aruba
                            6000 switch)

show running configuration  (shows ap & aaa rules are carried from
                            the master to the slave)
```

Checking the Configuration

Verify connectivity by pinging between the switches, the AP's, and the Avaya Voice Priority Processor and Avaya Call Server.

The switch and AP are now ready for use with wireless IP telephones.

To show AP settings:

```
show ap config location x.y.z
```

To show all APs connected to a switch:

```
show stm connectivity
```

To show clients associated all APs:

```
show station-table
```

To show clients associated to a specific AP:

```
show ap status <ip of ap>
```